and, fusing from the *bottom side*, gradually dissolved. I then placed similar blocks of metal endwise on, when, dipping beneath the surface, they bounded back to the surface, and subsequently dissolved, endway down. These results apply to various weights and sorts of compounds. I then conducted similar experiments with cast-iron, and found that the facts were still more conspicuous in the cast-iron (all of the same tendency) than in brass.

"Placing the iron on the surface of the liquid iron, a rapid chill set in, and a coating of iron, apparently about ¼" thick, attached itself to the cold iron, but very shortly re-melted, when the cold iron disappeared with it. I then dropped a small piece of cold iron (the same being dried to prevent explosion) endwise on to the surfaces of the liquid metal, when, bounding back to the surface, it melted in that position.

"The argument applies precisely to the experiments conducted in lead.

"In all cases the cold metals were relieved of any exterior ingredient by being well filed over. In every case of brass and iron the material melted was about 1" in diameter and 4" in length, each piece being round. With regard to the lead, the pieces varied in size, weight, and form, but all the experiments resulted in the same way. "JOSEPH WHITLEY"

"*Railway Works, Leeds*, April 11, 1878

"MY DEAR DR. MUIRHEAD,—Confirming my letter of yesterday, I have now to report the results of several experiments which, you will see, perfectly coincide with and demonstrate the truth I have again and again assured you of, viz., that all liquid matters that are susceptible of solidification will, when solid, float upon similar matter when in a liquid state.

"I intimated to you in my last that I feared I could not, in a small crucible, sufficiently fuse granite and whinstone, and in my experiments of yesterday, although I melted my crucible, I did not sufficiently liquefy the granite so as to float a piece upon the liquid mass. I therefore deferred further manipulations till to-day, and having secured a quantity of whinstone, I also determined to alter my course and to take advantage of a much larger focus of heat than that of a furnace 30" × 20" × 20", with a 60-lb. crucible. So I called upon Messrs. Taylor Bros. and Co., ironmasters of this town, and with their permission I proceeded as follows:—

"Being passed over by their manager to a subordinate officer—a worthy and very intelligent fellow, and, by the way, a strong believer in the doctrine that matter sinks in like matter when melted—we went to a furnace where we had three tests with whinstone, which he said disappeared, and I believe that he was justified in the two first experiments, because he was not sufficiently up in his observation as to notice a stream of gas liberated from a bubble formed on the surface by the melting of the whinstone immediately under it. In the next furnace we went to we had a large quantity of liquid 'cinder' 'tapped out' of a furnace into a trough. I really wish you could have seen it; to me the sight was grand, the gases given off by the melting of the whinstone blazed with a sort of blending of tints of purple, yellow, and green. I never saw anything so fine in flame. The whinstone was like a thing of life, so buoyant—of course the specific gravities of the liquid and solid materials varied considerably, and hence the buoyancy of the whinstone. We then tried a large number of small pieces of cinder—same as the liquid mass before us; but my friend the officer insisted that they went to the bottom—they certainly, except in one instance, never returned to the surface, because they liquefied before they had time to rise. My whinstone being done, and seeing that the results were not so satisfactory to my friend, I remarked that I was prepared to go all day and all night rather than give up the task of convincing him that his conclusions were wrong. I therefore suggested we should take a larger furnace, and deal with larger masses. We therefore, instead of dealing with quantities of 8 oz. weight, and weights of 1 lb., took pieces of 5 and 6 lbs. weight, each of solid cinder. Had my faith not been implicit I might have been deceived, for No. 1, 2, and 3 pieces went to the bottom, and my friend said, 'Now are you satisfied?' and I replied 'No, I am not.' Imagine his astonishment when No. 1 came bounding to the surface, and floated about like a cork, when the mass of heat had dissolved the coating which it clothed itself in at entering the bath and had begun to melt the original piece, up came No. 2 and 3, and I let him float them about on the surface with an iron rabble, so as to sear, as it were, the lesson sufficiently deep into his soul that it might never be erased. There were eight or nine jolly fellows looking on, and who enjoyed the joke, when my friend took off his hat and bowing politely said, 'Well, I am exceedingly obliged for the lesson you have taught me, and I shall never forget that all solid matter floats upon like matter when melted, as ice floats upon water.' Of course I had a joke and told him he was only one of a few who believed in the doctrine, and that he was the last convert. "JOSEPH WHITLEY"

P.S.—In the name of science I take this opportunity of tendering to Messrs. Taylor Bros., of the Clarence Iron Works, Leeds, my grateful thanks for their generous acquiescence in my request, and the facilities they kindly rendered in the experiments.—J. W.

THE INFLUENCE OF LIGHT UPON BIOPLASM[1]

SOME twelve months ago we briefly recorded in NATURE the results of our observations on the effect of sunlight on bacteria, and other organisms commonly associated with putrefaction and decay. Most of the experiments were subsequently described in detail in a paper communicated to the Royal Society. The chief of our earlier conclusions may be summed up shortly as follows:—

1. Light is inimical to, and under favourable conditions may wholly prevent, the development of these organisms, its action on the common forms of bacteria being apparently more powerful and rapid than upon the mycelial fungi which are prone to appear in cultivation-fluids.

2. This action appears to attain its maximum in the waves of greatest refrangibility. It is demonstrable in yellow light, but towards the red end of the spectrum sinks to a minimum.

3. The fitness of the cultivation-fluid to act as a nidus is not impaired by the insolation.

We found, moreover, that tubes containing a cultivation fluid and plugged with cotton wool, when removed to a dark place after exposure to the sun for a sufficient period remained perfectly clear and free from organisms for months. We thought, therefore, that the "germs" in these solutions had been completely destroyed by the solar rays.

While, however, we believe that, if the insolation be sufficiently prolonged, all the germs or spores originally present may be killed, and that, as regards bacteria, the insolation, under favourable conditions, need not be of very long duration, we have reason to think that, by *cell-walled* organisms, the destructive action of light may be resisted for a considerable period, and that the first result is to reduce the spore to a state of torpidity in which it may lie dormant for many months.

The investigation of this point, however, must necessarily extend over a long time; and in the above remarks we would wish to be understood as offering a suggestion rather than a definite conclusion.

We noticed last year that sunlight had no retarding effect on the *action* of the "indirect ferments," or, at least, of the soluble ferment of yeast (*zymase* of Béchamp, *ferment inversive* of Berthelot), which we used for our experiment. More recently, however, we have tested the effect of prolonged insolation on the soluble ferment itself, and have found that, at the end of three weeks' exposure to a midsummer sun, the *zymase* had entirely lost its characteristic property of hydrating cane-sugar, while a corresponding specimen, which had been kept in the dark, still retained its energy. It would appear, therefore, that the action of light affords no means of distinction between the "organised" and the "indirect" ferments.

We have attempted to elucidate the intimate nature of this action of light upon the organisms which have formed the subject of our experiments, and we have evidence pointing strongly, as we think, to the solution of the problem. Early in 1877 we set ourselves to this task, and, in order to obtain some insight into the effect of light upon certain organic bodies, we made a number of observations upon oxalic acid.

We have elsewhere[2] shown that a solution containing 0·63 per cent. (decinormal) is entirely decomposed by a somewhat prolonged exposure to strong sunlight when air is present. We now find that in a corresponding solution, *in vacuo*, no change

[1] By Arthur Downes, M.D., and T. P. Blunt, M.A. Oxon.
[2] *Chemical News*.

whatever is produced. This points conclusively to oxidation as the cause of the phenomenon.

We may here remark that this conclusion agrees with the results of the recent observations of M. Chastaing[1] upon a number of organic bodies, which he found to be oxidised under the influence of light.

As regards our oxalic acid, we have also determined that the oxidation in this instance is probably of the hydrogen and not of the carbon of the molecule.

From analogy and from direct experiment we believe that the mode in which light injuriously affects the organisms with which our investigation deals, is neither more nor less than a gradual oxidation of their living bioplasm, similar to the oxidation of the comparatively simple molecule of oxalic acid.

There is a lingering belief in the minds of many that matter which is endowed with life can by its "vital resistance" the more endure and survive the effect of injurious influences. This belief, derived, perhaps, like many others from a misapprehension of the indirect for the direct and from a misapplication of analogies, has no support from our experiments. On the contrary, we have met with results which are best explained by the consideration that bioplasm is matter of the utmost complexity and instability of constitution, ever-changing and most instable when the vital forces are at their full. We believe, in a word, that instability of this life-stuff is a predisposing cause for the destructive action of light, while in its stabler conditions it is more resistant.

We wish to keep this note within the limits of brevity, and will only remark in conclusion that, since the organisms which have been the subject of our work may be regarded as "life-units," well fitted by their tenuity for the demonstration of the action of sunlight upon the "physical basis" of their life, we may reasonably expect, and, indeed, may see, that this action is not limited to these special cases. We have chosen, therefore, in the heading of these remarks, to indicate the wider field of their application, but we by no means wish to imply that the relations of light to bioplasm are in all cases so simple.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

AT the Graduation Ceremonial in Medicine and Law in connection with the University of Edinburgh held on August 1 the honorary degree of LL.D. was conferred on James Risdon Bennett, M.D. Edinburgh, F.R.S., President of the Royal College of Physicians, London, Sir Joseph Fayrer, M.D. Edinburgh, K.C.S.I., F.R.S., John Richard Green, M.A. Oxon, Joseph Lister, M.B. London, F.R.S., lately Professor of Clinical Surgery in the University of Edinburgh, and now of King's College, London.

AT the annual meeting of the Council of the Royal School of Mines the prizes were awarded as follows:—The two Royal Scholarships, of 15*l.* each, for first year's students, to Mr. R. G. Scott and Mr. W. Cross; the Royal Scholarship, of 25*l.*, to Mr. R. Lancaster; the Edward Forbes medal and prize of books, to Mr. P. F. Frankland; the De la Beche medal and prize of books, to Mr. F. G. Mills; the Murchison medal and prize of books, to Mr. M. Terrero; and an extra medal to Syed Ali.

MRS. CATHERINE DAUNTESEY FOXTEN has bequeathed to Owens College, Manchester, the sum of 5,000*l.* to found two scholarships, one Legal and the other Medical.

WORK has been commenced on the extensive edifices of the new Berlin Polytechnic, which is to be situated a short distance out of the city at Charlottenburg. Five years are expected to elapse before the completion of this much-needed institution.

THE city of Lille has received from the French Department of Education the sum of 50,000 francs to assist in the foundation of a medical school.

THE Imperial ukase announcing the foundation of the new Siberian University states that it shall number four faculties, the medical, the legal, the historico-philosophical, and the physico-mathematical. Orders have been issued for the prompt construction of the edifices, towards the expense of which the provincial government of Tomsk has already appropriated 250,000 roubles—about 35,000*l.*

[1] *Ann. de Chim. et de Phys.*, 5 ser. t. xi.

SCIENTIFIC SERIALS

Kosmos, April.—On life in Kosmos, by Carl du Prel, discussing possibilities of life in other worlds than ours.—The kingdom Protista, first part, by E. Haeckel.—On the physiology of the new-born, by M. Preyer. Part 1: On hearing and sight.—On the nests and gardens of *Amblyornis inornata*, or, rather, theories about them, by O. Beccari.—The sway of ceremonial, by Herbert Spencer. Part 4: On presents.—The discontinuance of human sacrifices, by E. Krause.

May.—The kingdom Protista, by E. Haeckel, describing Amœba, Protococcus, Euglena, Flagellata, Volvocina, Noctiluca, Infusoria, Acineta, Rhizopods, Foraminifera, and Radiolaria; forty-one excellent woodcuts.—On the physiology of the newly-born, by M. Preyer; on smell and taste.—The animal kingdom, as regards similarity of adaptations, by W. von Reichenau.—The sway of ceremonial, by Herbert Spencer: On marks of honour.—Sexual selection in plants, by W. Focke.

June.—Contribution to experimental æsthetics, by Rudolf Redtenbacher, pursuing Fechner's researches and discussing his results, analysing the causes of pleasure as regards the shapes and textures of flat surfaces, as well as of crystals.—Ernst Haeckel continues his popular articles entitled "The Kingdom Protista." He diverges very much into theory as usual, expounding his doctrine that the true animal kingdom is defined by the formation of a gastrula in its embryonic stage. On the side of phylogeny he considers the protista ascended to true animalism by becoming parasites.—Fritz Müller describes the queens of the Meliponæ, investigated in Brazil. He finds in four species the queens, or in some cases the parthenogenetic females, extraordinarily alike, while the males and workers are very different.—Herbert Spencer's sixth paper on the sway of ceremonial deals with forms of address; these articles are extracted from the future second volume of "Sociology."

Zeitschrift für wissenschaftliche Zoologie, vol. xxx. part 4.—On the origin of the sexual products in hydroida, by J. Ciamician; two plates of tubularia and endendrium.—Further contribution on the genus analges or dermaleichens (crustacean), by G. Haller; three plates.—On the structure of *Reniera semitubulosa* (sponge), by E. Keller; two plates.—On the structure of the Malpighian vessels of insects, by E. Schindler; 74 pages, three plates.

Vol. xxx., supplement, part 2.—Anatomical and zoological observations on the amphipods and isopods, by F. Leydig; fifty pages, four plates.—On the development of the testes and the alternation of generations in the salpæ, by W. Salensky.—On a mathematical method in zoology, illustrated from the acarida, by P. Kramer.—The reproductive organs of some ectoparasitic trematodes, by Carl Vogt; four plates, thirty-seven pages.—On the movements of "flying fish" through the air, by Karl Möbius; one plate, forty pages; giving an account of all observations on the movements of these fish, the anatomical structures on which they depend, and the way in which the mechanism works.—Studies of the freshwater fauna of Switzerland, by F. A. Forel. He distinguishes the characters of the littoral, the pelagic, and the deep-sea fauna of Lake Leman; discusses the relations between the present fauna and that of recent geological periods, and the migrations of species; and concludes that the lacustrine fauna of the subalpine waters has entered by migration since the glacial period; that the littoral fauna has come from other lakes of other lands; the pelagic fauna from forms already differentiated as such before migration; and the deep fauna by modification from the littoral.—On mud-dwelling cladocera, by W. Kurz; one plate, eighteen pages.

Vol. xxx., supplement, part 3.—On the early embryonic development of *Tendra zostericola*, by W. Repiachoff, one plate.—On the comet-forms of star-fishes, with a discussion of the phylogeny of the echinodermata, by E. Haeckel, one plate.—Contributions on protozoa, by A. Schneider: on actinosphœrium; on development of miliola; on trichosphærium and chlamydomonas, one plate.—On the form and signification of organic muscle-cells, by W. Flemming. The author believes he has discovered the development of unstriped muscle-cells in *Salamandra maculata* out of connective tissue cells, one plate.—On the anatomy of the entomostracan *Limnadia hermanni*, by F. Spangenberg.—Studies on the history of the Polish Tur, by A. Wrzesniowski. In this exhaustive paper of sixty pages all the historical references are examined, and most interesting woodcuts copied from representations of two animals are given. The conclusion is that two of the Bovidæ